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ORIGINAL

VALIDATION OF THE COMPETITIVE STATE ANXIETY INVENTORY 2 (CSAI-2 RE) THROUGH A WEB APPLICATION

VALIDACIÓN DEL COMPETITIVE STATE ANXIETY INVENTORY 2 REDUCIDO (CSAI-2 RE) MEDIANTE UNA APLICACIÓN WEB

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ABSTRACT

The Competitive State Anxiety Inventory 2 (CSAI-2) is a 27 item questionnaire consisting of 3 dimensions: Cognitive Anxiety, Self-confidence and Somatic Anxiety. A total of 231 athletes, aged 14 to 42, of both genders and different sports completed the Teskal Web application. Its aim is to validate a reduced version which shows similar psychometric qualities to the original version. A Confirmatory Factor Analysis (CFA) was conducted and the internal consistency coefficients of both were found. The results obtained in the CFA fit indices and the internal consistency leads us to conclude that the computerized and reduced version of the CSAI-2 is robust and sustains the factorial structure of the original one. Therefore it is adequate for measuring the anxiety state of athletes involved in sports-competitive contexts, both in research as well as in intervention.

KEY WORDS: Cognitive Anxiety, Somatic Anxiety, Self-confidence, Sports Performance

RESUMEN

El Competitive State Anxiety Inventory 2 (CSAI-2) es un cuestionario de 27 ítems que consta de 3 dimensiones: Ansiedad Cognitiva, Autoconfianza y Ansiedad Somática. Empleando la aplicación Web Teskal se han recogido las respuestas de 231 deportistas de ambos sexos y diferentes modalidades deportivas, con edades comprendidas entre los 14 y los 42 años. Se trata de validar una versión reducida, que muestre similares cualidades psicométricas que la versión original. Se llevó a cabo un análisis factorial confirmatorio (AFC) y se hallaron los coeficientes de consistencia interna de ambas versiones. Los resultados obtenidos en los índices de ajuste del AFC y de la consistencia interna nos llevan a concluir que la versión informatizada y reducida del CSAI-2 es robusta y mantiene la estructura factorial de la original. Por lo tanto resulta adecuada para medir la ansiedad estado de deportistas inmersos en contextos deportivo-competitivos, tanto en investigación como en intervención.

PALABRAS CLAVE: Ansiedad Cognitiva, Ansiedad Somática, Autoconfianza, Rendimiento Deportivo

1. INTRODUCTION

Anxiety is one of the most cited psychological constructs from all paradigms of Psychology. From Psychoanalysis (Freud, 1917) to Behaviourism (Skinner, 1979; Wolpe, 1981) all through the Cognitive viewpoint (Beck y Emery, 1985) all of them have underlined the importance of anxiety in emotional and rational processes. Therefore, anxiety is one of the most measured constructs in Psychology of Sport. There have been more than 20 scales published with regard to that topic (Ostrow, 1996). But undoubtedly the best known and used tool in the sport field is the CSAI-2 (Martens, Burton, Vealey, Bump y Smith, 1990).

In order to make the competitive anxiety feature operational, Martens (1977) drew up the first *Sport Competition Anxiety Test* (SCAT). After using this tool in several studies, he saw the need to make a scale aiming at the measurement of states of anxiety specifically in competitive situations. Therefore, Martens, Burton, Rivkin and Simon (1980) took the State Anxiety Inventory (SAI) by Spielberger (Spielberger, Gorsuch and Lushene, 1970) then chose those 10 items which were the most sensitive to changes in the sport field from the SCAT and created the *Competitive State Anxiety Inventory* (CSAI) to measure the sport-specific state-anxiety. This tool evolved into the *Competitive State Anxiety Inventory 2* (CSAI-2) two years later.

The first CSAI-2 (Martens, Burton, Vealey, Bump y Smith, 1990) included scales to measure not only somatic and cognitive state anxiety but also fear to physical harm and general anxiety. To start with, a set of 102 items were produced and these were assessed by three experts on the basis of syntax, grammatical clarity and contents validity. Many of the items were deleted and some more were drawn up again, after which 79 items were left, and these made form A of the tool. Again the authors applied this form to a sample of 162 subjects which included undergraduate football players and Physical Education students. Their answers were tested through several analyses: item analysis, subscale-item correlation, factor analysis, linear discriminant analysis. After completing the analysis and subsequently deleting the least relevant items, the questionnaire came down from 79 to 36 items and factors congruent with *cognitive state anxiety, somatic state anxiety and fear to physical harm* were produced, but a general factor of *anxiety* was not verified. Also some unexpected findings came up in the *cognitive state anxiety* subscale. After confirmation in several ways, *cognitive state anxiety* was divided into two subcomponents. One factor comprised all items regarded as positive and was termed *self-confidence state*, while all the items that had a rather negative interpretation were put together into another factor which was termed *cognitive state anxiety.* However, it was demonstrated that the relationship between these two subcomponents was not reciprocal by any means. Although they showed an inverted correlation pattern, depending on the sample and the circumstances, the oscillation range was too wide according to the authors. The subsequent research suggested that this kind of response pattern was influenced by social desirability and other factors which are inherent to the use of self-report inventories (Cronbach, 1998). Finally, they opted for separating both subcomponents in order to give a more realistic view of precompetitive opinions (challenge, threat or both). The authors, therefore, deleted 43 items and termed this new version of their questionnaire form B. The new 36 item questionnaire had 12 items in the *somatic state anxiety* subscale, 12 items in the *cognitive state anxiety* subscale, 10 items in the *self-confidence state* subscale and 2 items in the *fear of physical harm* subscale. These 36 items were tested with the first sample of 162 athletes and the previous analyses were applied again (item analysis,

subscale-item correlation, factor analysis, linear discriminant analysis). These analyses demonstrated the existence of 3 stable subscales: *somatic state anxiety, cognitive state anxiety and self-confidence state,* while the items from *fear of physical harm* subscale were deleted in subsequent versions of the test because they did not add much information. Since the *self-confidence state* subscale had not been a component of the original CSAI-2 in the first place, after deleting the less discriminant items the scale was reduced to 7 components. Then 6 new items were added to the *self-confidence* scale plus another 6 new ones for control. Thereby the inventory had 3 subscales of comparable length. Also it was considered that the Rotter (1966) *Internal-External Locus of Control* construct could make an important component in the *self-confidence* scale and so 12 items from this construct were added. To sum up, 8 items from the previous version were deleted and 24 new items added, so that the new version comprised 54 items and 4 subscales: 14 items in the *cognitive anxiety* subscale, 11 items in the *somatic anxiety* subscale, 13 items in the *self-confidence* subscale and 12 items in the *Internal-External Locus of Control* subscale. This made version C of the CSAI-2 tool and was applied to a sample of 80 participants (swimmers, athletes, wrestlers and cyclists) who completed it one hour before their challenges (Martens, Burton, Vealey, Bump y Smith, 1990). The resulting data were tested by means of scale-item correlation, factor analysis and linear discriminant analysis. These tests demonstrated the existence of 3 out of the 4 hypothetical subscales. The *Internal-External Locus of Control* dimension was not revealed as a recognisable factor, hence it was discarded for good. Also those items that saturated below .40 were deleted from all other subscales. Therefore, the new version of the tool (form D) comprised 3 subscales: *cognitive state anxiety, somatic state anxiety and self-confidence state.*

Taking different samples of participants (athletes and wrestlers), these authors estimated the reliability and validity indices. In this way the internal consistency of the different subscales of the CSAI-2, using the Cronbach alpha index (Cronbach, 1951), yielded values between .79 and .90. In order to check the concurrent validity, scores obtained through the CSAI-2 were correlated with other scores that measured trait anxiety, as for instance, SCAT (Martens, 1977), TAI (Spielberger et al., 1970), AAT-C (Alpert and Haber, 1960) and the IECS (Rotter, 1966). And also with other measures aiming at state anxiety, as for instance WEI (Morris, Davis and Hutchings, 1981), CSAQ (Schwartz, Davidson and Goleman, 1978), SAI (Spielberger et al., 1970) and the CAL (Zuckerman, 1960). These tests also produced encouraging results. Finally and in order to correct some drawbacks linked to self-report measures --caused by the tool instructions-- like social desirability (Cronbach, 1998), a new version was created (form E) which made the final version of the tool and became widespread afterwards.

Since its creation the CSAI-2 has been sufficiently checked in a large number of science periodicals which have used this tool at both national and international levels. In sport it has been used for different aims which can be batched along three main research tracks: on the one hand, those that study the link anxiety has with other psychological constructs like motivational orientation (Cecchini, González, Carmona and Contreras 2004; Jones and Swain, 1992), with other personality features (Thomas, Maynard and Antón, 2004) or with physical abilities like endurance (Hammemeister and Burton, 1995) or heart rate (Cervantes, Rodas and Capdevila, 2009); a second track has dealt with the effects that anxiety brings on different measures of athletic performance (Abenza, Alarcón, Ureña, Piñar, 2009; Gutiérrez, Estévez, García and Pérez, 1997; Maynard, Hemmings and Warwick-Evans, 1995; Polman, Rowcliffe, Borkoles and Levy, 2007); and a third one has focused on the assessment of the impact that different techniques of psychological training

bring about, like progressive relaxation training, rational emotive programmes or imagery practise in anxiety factors (Elko y Ostrow, 1991; Estrada y Pérez, 2008; Hale y Whitehouse 1998; Navarro, Amar y González, 1995).

The CSAI-2 has been used with samples of athletes (Hammemeister and Burton, 1995; Jones, Swain and Cale 1990; Swain and Jones, 1992), soccer players (Hale and Whitehouse, 1998; Maynard, Hemmings and Warwick-Evans, 1995), gymnasts (Elko and Ostrow, 1991), wrestlers, canoeists, triathletes, surfers and golfers (Telletxea, 2008), among others. Also the tool has been translated into several languages --Spanish, French, Greek, Swedish-- and it has undergone several tests of reliability and factor validity with different and wide samples (Cox, Martens and Russell, 2003; Lundqvist and Hassmén, 2005; Martinent, Ferrand, Guillet, and Gautheur, 2010; Tsorbatzoudis, Barkoukis, Kaissidis-Rodafinos and Grouios, 1998). Our research paper belongs to the latter kind of studies.

Besides and taking into account the frenzied development of society and the powerful and increasing setting up of the ICT in our daily life, we have decided to take a step ahead and computerize the traditional CSAI-2 version which so many good results has brought to date. At the latest AASP Congress, held in Providence in 2010, a mention was made during the opening talk of the advantages the ICT bring to improve interventions with athletes (Weinberg, 2010). These advantages included, among others, the possibility to keep psychologist-athlete communication for 24 hours a day, 7 days a week and 365 days a year, or the possibility to assess and monitor athletes regardless of the part of the world they may be in. Also, the ICT bring additional advantages when it comes to hand in the questionnaires used in Sport Psychology, better control and precision at defining the items, better recording of time and answering processes, easier correction and collation of data, quickness and efficiency handing back results (Dosil, 2004; Dosil and García-Prieto, 2004; Lozzia, Abal, Blum, Aguerri, Galibert and Attorresi, 2009; Olea, Abad and Barrado, 2010; Olea, Ponsoda and Prieto, 1999; Watson, Tenenbaum, Lidor and Alferman, 2001).

Alongside these advantages there is the need to check that turning these questionnaires into computerized versions does no reduce the psychometric properties of the traditional paper versions used so far (Mead y Drasgow, 1993; Olea, Ponsoda and Prieto, 1999). Therefore, the first aim of this study is to put the computerized version of the CSAI-2, as regards its psychometric properties, on a level with the traditional one as mentioned above.

This study has demonstrated that we have a solid tool, made up of 27 items, to measure anxiety in athletes. But since we intend it to become a tool of everyday use for high performance athletes who take part in programmes of psychological intervention, the second aim of the present study is to substantially reduce the number of items, but keeping the indices of reliability and validity at an acceptable level.

2. METHOD

2.1. PARTICIPANTS

The sample comprised 231 athletes, 141 men and 90 women, both from individual and team sports (surfing, golf, judo, athletics, soccer, basketball, cycling, canoeing,

snowboarding) and from different performance levels (national and international), who were taking part in a programme of improvement and optimization of psychological resources. The eldest participant was 42 and the youngest, 14. The age mean was 20.7 and the standard deviation 6.2. A total of 50 of them played at international level (European, World and Olympic Games championships) and 181 played at national level (Autonomous Community or Spanish championships).

2.2. PROCEDURE

After a first briefing with the athletes, they were introduced to the TESKAL application and were registered as users. Each one was provided with an access key, predetermined by their respective researcher at first, but it could be changed at will afterwards.

The CSAI-2 data was collated by means of the Teskal application (www.teskal.com), as mentioned above. Having free access to the programme, and choosing their most convenient time and place, the athletes completed the tool as part of the first appraisal of the season. Teskal allows data to be collected, saved and exported from the MySQL 5.0. database. This has got the advantage that data can be uploaded to the relevant statistics programme and there cannot be any lost cases (the programme does not allow to save any incomplete answers), because if the athlete forgets to fill in an item, the programme issues a message requesting the user to complete it. Since the athletes were included in an intervention programme, the date was collected in 2007, 2008 and 2009. Then the data were exported to the SPSS 15.0 statistics programme which was used to conduct the internal consistency analyses. Confirmatory Factor Analyses were carried out by means of the AMOS 18.0 programme (Arbuckle, 2009).

2.3. TOOL

The tool was the Spanish translation (by Capdevila 1997) of the English version of the CSAI-2 (Martens et al., 1990), later revised and used by other researchers (Arruza, Telletxea, Azurza, Amenabar y Balagué, 2001; Telletxea, 2008) in research studies and doctoral theses. This questionnaire assesses the cognitive and somatic components of state anxiety and self-confidence with regard to sport performance related to competition. It comprises 27 items which test three factors: cognitive anxiety state, somatic anxiety state and self-confidence. Athletes answer each item as defined by the general statement: “Before competition...”. Answers are chosen from an option of four offered on a Likert type scale of 4 categories, 1 meaning “nothing” and 4 meaning “a lot”.

3. RESULTS

3.1. Item distribution analysis

As concerns the distribution of items in the CSAI-2 it is worth mentioning that the univariate normality of data, determined by the asymmetry and kurtosis of the items, showed that asymmetry values ranged from -0.95 to 2.47 and kurtosis values from -1.271 to 5.83. Concerning how significant Kolmogorov-Smirnov-Liliefors indices were, all cases had a $p<0.01$ value, therefore null hypotheses in normal item distribution was rejected. Data multivariate normality measured with Mardia coefficient (1985) offered a value of 167.52 with a critical ratio equal to 32.17. Some researchers have suggested that critical

proportion values above 3 show a worrying data normality. In our case, the analyses revealed a violation of the Gaussian multivariate normality, so it was decided to readjust value p from χ2 statistics with Bollen-Stine boot-strapping method (1993). Some studies (Nevitt y Hancock, 1997) suggest that Bollen-Stine χ2 statistics (χ2 (B-S)) is efficient with small samples and would be equivalent to Satorra and Bentler (1994) robust procedure.

3.2. Original Model

Following the theoretical model proposed by the tool authors (Martens et al., 1990) (Figure no.1), the introduced model had 3 latent variables (factors), each of them associated to 9 observed variables (items) which made a total of 27 observed variables (items). Endogenous variables were correlated but not the errors associated to the exogenous variables. In order to give a scale of measure to the latent variables a loading per factor was fixed to 1. Likewise all the error variances of the indicators were fixed to 1. The parameters to be estimated comprised 3 covariances within the latent factors, 27 regression coefficients from the factors to the indicators and 27 error variances. The measurement model was over-identified with 405 non redundant moments in the sample matrix and 84 free parameters to be estimated. After specification and identification, the result was a 3 factor model (Cognitive Anxiety, Self-confidence, Somatic Anxiety) into which those 27 items were included.

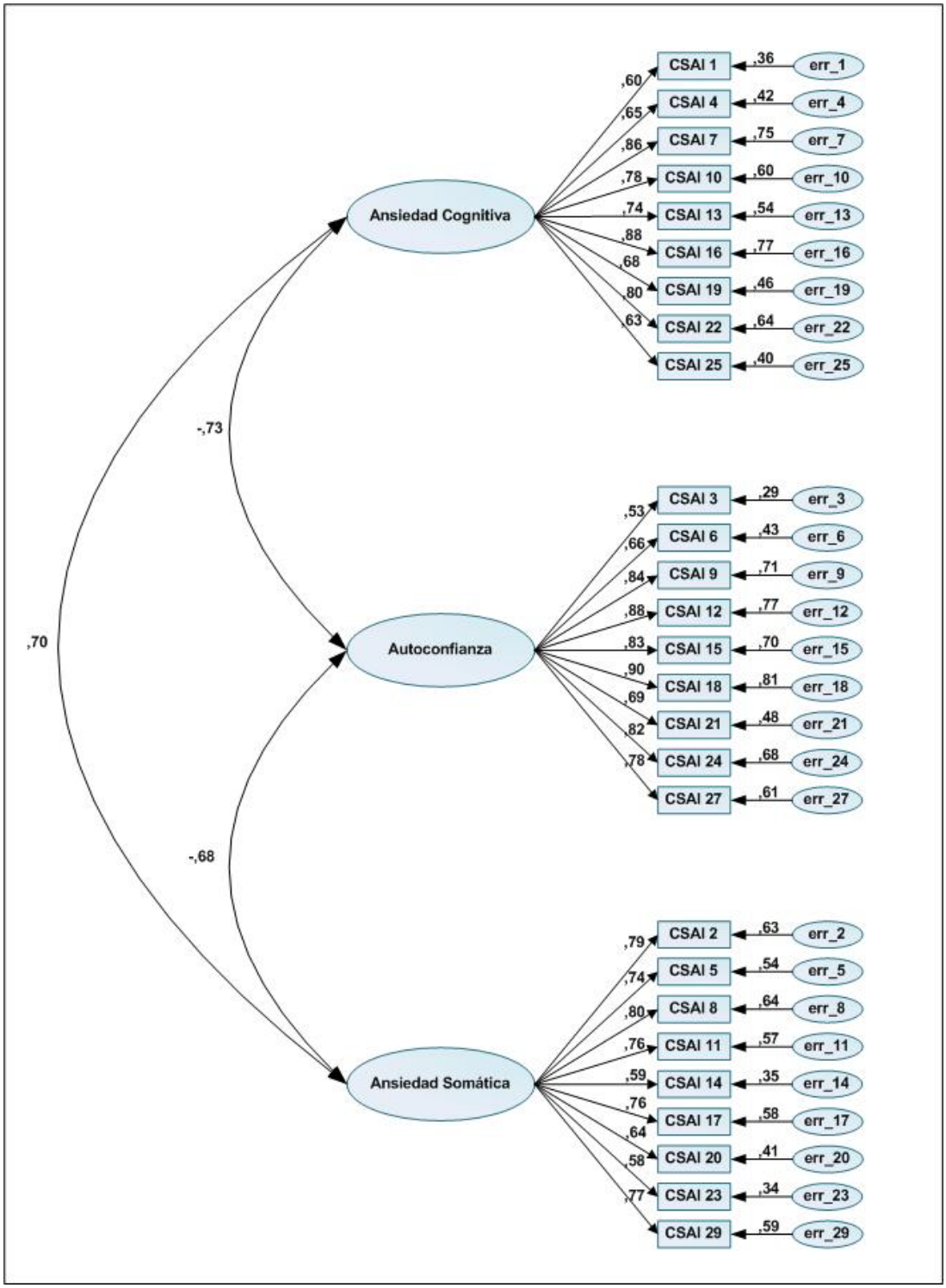

Figure 1. Original Model

The standardized solution for the CSAI-2 first model revealed significant regression weights for all items (p<0,001). With regard to the goodness of fit indicators (see Table 1), BS chi-squared was significant, $\chi 2$ (321) =725.908, p=0,001, and RMSEA was .074. Also NFI and CFI incremental fit indices were .84 and .90 respectively, while PNFI and PCFI parsimony indices were .77 and .82 respectively too. The combination of all these results suggests that the initial CSAI-2 hypothesized model had a poor fit to the data.

3.3. Respecified Reduced Model

In order to produce a new model starting from the initial one, two criteria were taken into account: on the one hand, with regard to cross regression weights, Modification Indices (MI) were considered and, on the other, items with the lowest saturation indices in relation to their hypothesised factor were deleted. Thereby, according to the first criterion, items 4, 14, 17 and 21 were deleted, and following the second criterion, items 1, 3, 6, 19, 20, 23, 25 and 27 were left out.

The model thus respecified (Figure 2) comprised 3 latent variables (factors), each one associated to 5 observed variables (items), which made 15 observed variables (items) all told. Endogenous variables were correlated, not so the errors associated to the exogenous variables. In order to give a scale of measure to the latent variables a loading per factor was fixed to 1. Likewise all error variances of the indicators were fixed to 1. The parameters to be estimated comprised 3 covariances within the latent variables, 27 regression coefficients from the factors to the indicators and 27 error variances. The measurement model was over-identified with 135 non redundant moments in the sample matrix and 48 free parameters to be estimated. The result after specification and identification was a 3 factor model (Cognitive Anxiety, Self- confidence, Somatic Anxiety) into which those 15 items were included.

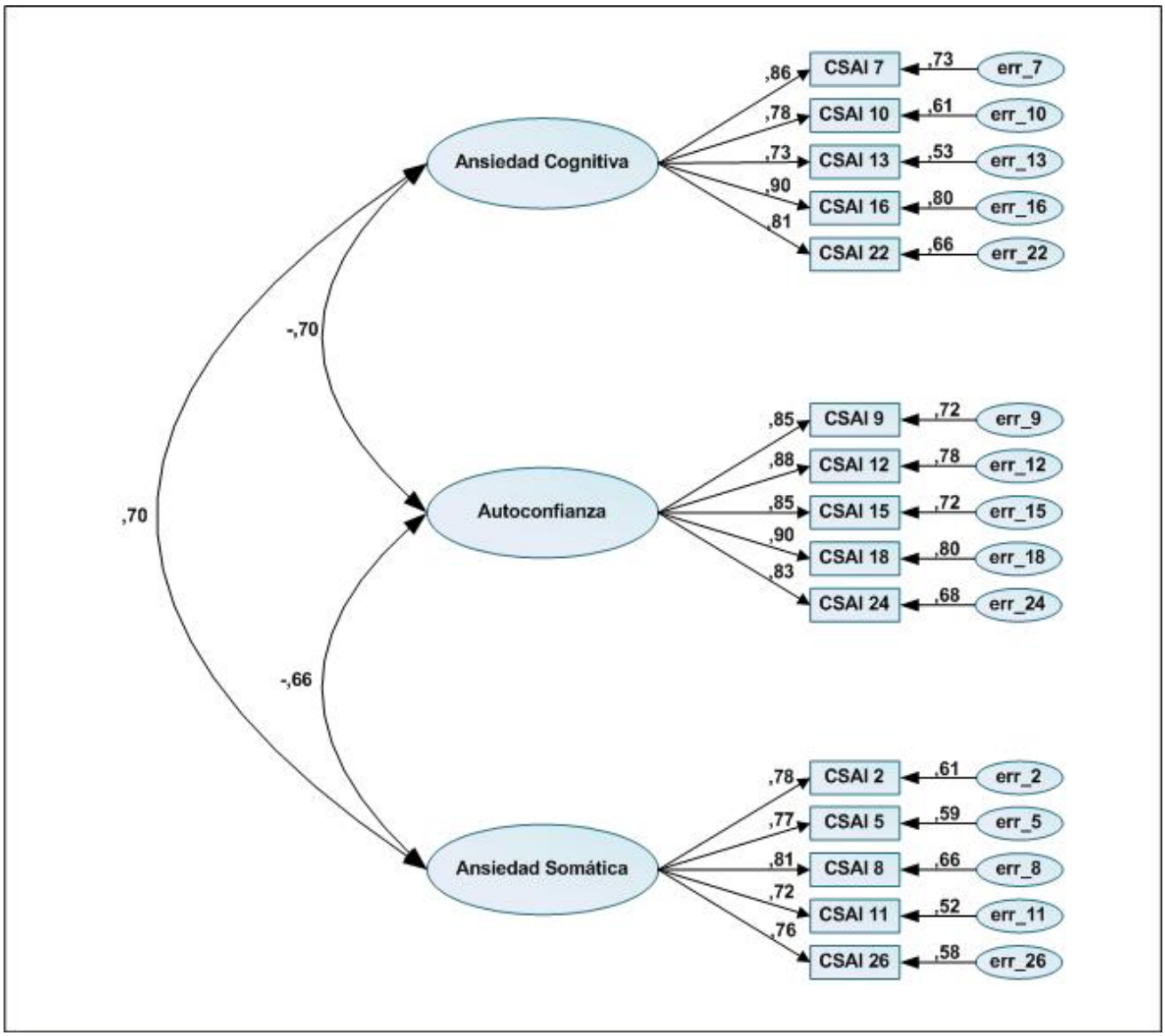

Figure 2. Respecified Model

On this second occasion the standardized solution for the respecified model revealed significant regression weights for all items (p<0,001). With regard to the goodness of fit indicators (see Table 1), Bollen-Stine chi-squared was not significant, $\chi 2$ (87) =132.649, p= .139, and RMSEA was .048. Also NFI and CFI incremental fit indices were .95 and .98 respectively, whereas PNFI and PCFI parsimony indices were .78 and .81, in that order. The combination of all these results suggests that the CSAI-2 respecified hypothesized model had a good fit to the data.

Table 1. *Summary of goodness of fit indices of the models*

	Absolute fit indices		Incremental fit indices		Parsimony indices	
	χ^2 (B-S)	RMSEA	NFI	CFI	PNFI	PCFI
Original CSAI-2	725,908 gl, 321 p<0,001	0,074	0,84	0,90	0,77	0,82
Reduced CSAI-2	132,649 gl, 87 p=0,193	0,048	0,95	0,98	0,78	0,81

3.4. Reliability

The reliability of the questionnaire was tested with Cronbach alpha coefficient (1951), since it is regarded as the most adequate for tools the final score of which comes from sums or point addition processes (Nunnally, 1976). The table below gives the reliability indices of the 2 versions of the CSAI-2.

Table 2. Indices of model internal Consistency

	Cognitive Anxiety	Self-confidence	Somatic Anxiety
Original CSAI-2	0,91	0,93	0,90
Reduced CSAI-2	0,87	0,93	0,90

4. DISCUSSION

The purpose of this study was twofold. On the one hand, to validate a computerized version of the traditional CSAI-2 on paper and, on the other, to produce a reduced version of the original one. The first purpose follows the aim of adapting to the new times, whereas the second comes after the need to save time in the process of measuring the different dimensions comprised in state anxiety as defined by the authors of the original study (Martens et al., 1990).

After completing the AFC of the 27 item scale it was respecified taking into account, on the one hand, the Modification Indices (MI) with regard to the crossed regression weights and, on the other, the saturation indices that the items showed as related to their hypothesised factor. It was decided to delete those items with the highest IM, and also those items with the lowest saturation with their respective factor. The essential utility of the IM comes down to the analysis of multicollinearity (Lévy Mangin, 2002). Whereas the second criterion comes after the need of the authors to substantially reduce the length of the tool. Thereby a total of 12 items were deleted which meant a reduction of approximately 45% in its initial length, but keeping the original three-factorial structure.

The assessment of the goodness of fit of a model is more a relative than an absolute process (Rial, Varela, Abalo y Lévy, 2006), therefore several types of fit should be combined in the assessment. Chi squared likelihood-ratio test (B-S) and RMSEA (*Root Mean Square Error of Approximation*) determine a set of absolute fit indices. A $p > .05$ of the first one would indicate a good fit, although it reveals great dependency of the sample size (García-Cueto, Gallo y Miranda, 1998). Whereas values below .05 in the second index (Browne y Cudeck, 1993) would indicate a good fit of the model. The NFI (*Normed Fit Index*) and the CFI (*Comparative Fit Index*), represent incremental fit indices and, in both cases, values below .9 would indicate that the model can be substantially improved (Bentler, 1990; Bentler y Bonnett, 1980). Whereas PNFI (Parsimonious Normed Fit Index) and PCFI (Parsimonious Comparative Fit Index) are indices of parsimony, therefore high values are advisable in both indices.

In our case, we have found $\chi 2$ (B-S) significant indices for the original model ($p<.001$) and no significant ($p= .193$) for the reduced model. The RMSEA has dropped from 0.074 in the original version to 0.048 in the reduced version. The NFI and the CFI have increased around 1 tenth after the model was reduced and respecified (The NFI went from .84 up to .95 and the CFI from .90 to .98), whereas PNFI and PCFI have kept virtually unaltered in spite of the respecification. The combination of all these results suggests that the CSAI-2 respecified hypothesized model has a good fit to the data and that the present theoretical model is still valid after respecifying the original model.

On the other hand, the indices of internal consistency of the items for the different dimensions of the scale are high, all of them above 0.8, which guarantees the reliability of the tool (Arce, 1994; Ayçaguer, 1997). The French version of the questionnaire has recently yielded similar findings (Martinent et al., 2010), therefore, and all things considered, we believe that in psychometric terms this is a valid and reliable CSAI-2 reduced version, which offers a high degree of utility in psychological intervention with all sorts of athletes regardless of age and condition. Also, it has been demonstrated that the computerized version does not modify the psychometric qualities of the traditional version.

The limitations of this study come basically from the sample taken. It may be regarded as somewhat scanty --231 subjects-- and also it might be termed as *"sample of convenience"* since the subjects were taking part in different psychological intervention programmes which tried to improve their capacities in competition. Also the age range of the participants is very wide and there is a remarkable unbalance as far as gender is concerned. Likewise, the fact that the CSAI-2 is a tool to measure competitive anxiety leads us to see this construct as a three-dimensional one, and takes us away from considering other possible dimensions in its configuration.

For future research we think it will be necessary to establish a better control of the sample by increasing the number of subjects and, as far as possible, improving the balance with regard to gender and sport level. On the other hand, it is advisable to define the relationships in between the subscales of the tool concerning other series of psychological dimensions, as it might be state of mind, tackling style or emotional intelligence of the athletes.

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